

# **WHAT MOONRISE LUNAR SAMPLE RETURN CAN TEACH US ABOUT MARS SAMPLE RETURN**

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Under consideration by NASA are two challenging robotic sample return missions: the MoonRise Lunar Sample Return, a New Frontiers proposal which could launch in 2016; and the Mars Sample Return (MSR) campaign, which could begin with the proposed Mars 2018 Sample Caching mission. Together they could represent the first wave of sample return missions envisioned from various solar system bodies.

While the MoonRise and Mars 2018 mission concepts are vastly different in their details, it is a worthy exercise to take several steps back to recognize their common attributes and technology needs, especially in the disciplines of entry, descent, and landing (EDL), sample acquisition, and surface operations. Even though both proposed projects are still early in their development cycles, a number of common technologies and systems engineering disciplines are emerging as enhancing, and, in some cases, enabling for both missions.

Additionally, lessons learned from the MoonRise Lunar Sample Return could also provide valuable insight for future legs of the Mars Sample Return campaign beyond the proposed Mars 2018 mission. Specifically, MoonRise experiences with Ascent, Earth Entry, Descent, and Landing (EDL), and sample recovery operations would provide useful guidance for the analogous phases of MSR. MoonRise, if selected, would return samples to Earth in 2017, the timing of which would allow the feed forward of flight system development knowledge and mission operations experience to the development of the proposed Mars Sample Return campaign.

As flight systems engineers for both the proposed MoonRise and the Mars 2018 sample caching missions, the authors have a unique vantage point to the challenges of both sample return missions and will discuss how MoonRise would build the experience base for a Mars sample return. Furthermore, lessons learned from the recently completed MoonRise Mission Concept Study and the on-going Mars 2018 concept development study suggest focus areas for technology investments, which could benefit future sample return missions under study at this time.